Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Cancelled)

2. (Previously Presented) An outlier and change point detection device for calculating outlier scores and change point scores for data described with a sequentially input discrete variate and/or continuous variate so as to allow for detection of outliers and change points of said data, said outlier and change point detection device comprising:

a first time-series model learning device for learning a probability distribution of the data as a time-series statistic model specified by a finite number of parameters;

an outlier score calculator for reading the parameters obtained through learning by said first time-series model learning device, and for calculating an outlier score of the data based on the read parameters of the time-series statistic model and the input data, and for outputting the outlier score;

a moving average calculator for sequentially reading each outlier score calculated by said outlier score calculator, and for calculating a moving average of the read outlier scores;

a second time-series model learning device for sequentially reading each moving average of the read outlier scores calculated by said moving average calculator, and for learning a particular probability distribution for the read moving averages as a particular time-series statistic model specified by a finite number of particular parameters; and

a change point score calculator for reading the particular parameters obtained through learning by said second time-series model learning device, and for calculating a particular outlier score for each moving average calculated by the moving average calculator based on the read particular parameters of the particular time-series model and the moving average calculated by the moving average calculator, and for outputting the particular outlier score for each moving average as a change point score of the data.

3. (Cancelled)

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4. (Previously Presented) The outlier and change point detection device of claim 2,

wherein said first time-series model learning device is configured to learn, in a case where the sequentially input data are described with continuous variate only, the probability distribution for generation of said data while sequentially reading real number vector values of the data and by using an autoregressive model; and

wherein the first time-series model learning device further comprises:

a data updating device for updating a sufficient statistic of the autoregressive model by forgetting at least a portion of past data that has been read and using newly read data of said data; and

a parameter calculator for reading the sufficient statistic updated by said data updating device, and for calculating a specific parameter of the autoregressive model using the sufficient statistic.

5. (Previously Presented) The outlier and change point detection device of claim 2,

wherein said outlier score calculator and said change point score calculator are considered as a single score calculator; and

wherein the outlier and change point detection device further comprises:

a sort device for sorting the data in descending order based on the outlier scores and the change point scores calculated by said score calculator; and

a display device for displaying a particular number of data pieces of said data with high scores according to the order sorted by said sort device as candidates for being outliers and change points of the data.

6. (Previously Presented) The outlier and change point detection device of claim 2,

wherein said outlier score calculator and said change point score calculator are considered as a single score calculator; and

wherein the outlier and change point detection device further comprises:

a score judgement device for outputting data pieces of the data that are over a predetermined threshold from the outlier score and the change point score calculated by said score calculator as the candidates of outliers or change points.

7. (Cancelled)

8. (Previously Presented) An outlier and change point detection method used for machine learning or data mining to detect candidate outliers and change points in a data series by calculating outlier scores and change point scores for a plurality of data pieces of the data series, said method comprising:

sequentially reading each data piece of the plurality of data pieces of the data series, and, for each data piece of the plurality of data pieces, performing processing when the data piece is read, said processing comprising:

learning at least one corresponding parameter of a corresponding probability distribution of a corresponding time-series statistic model related to the data piece based on one or more first data pieces that have already been read among the plurality of data pieces;

calculating a corresponding outlier score of the data piece based on the at least one corresponding parameter and one or more second data pieces that have already been read among the plurality of data pieces;

calculating, for the data piece, a corresponding moving average based on one or more previously calculated outlier scores for one or more third data pieces that have already been read among the plurality of data pieces;

learning at least one corresponding particular parameter of a corresponding particular probability distribution of a corresponding particular time-series statistic model related to the corresponding moving average based on one or more previously calculated moving averages for one or more fourth data pieces that have already been read among the plurality of data pieces;

calculating a corresponding outlier score of the corresponding moving average associated with the data piece based on the at least one corresponding particular parameter and one or more previously calculated moving averages for one or more fifth data pieces that have already been read among the plurality of data pieces; and

outputting the corresponding outlier score of the corresponding moving average associated with the data piece as the change point score of the data piece.

9. (Cancelled)

10. (Previously Presented) The outlier and change point detection method of claim 8,

wherein, in case the sequentially read plurality of data pieces are described with a continuous variate only, said step of learning said at least one corresponding parameter comprises:

learning the at least one corresponding parameter of the corresponding probability distribution using an autoregressive model;

updating a sufficient statistic of the autoregressive model using the newly read data piece while forgetting one or more past data pieces that were read before said data piece among said plurality of data pieces; and

calculating the at least one corresponding parameter of the corresponding probability distribution of the autoregressive model using the sufficient statistic.

11. (Previously Presented) The outlier and change point detection method of claim 8, further comprising:

sorting the plurality of data pieces in a descending order based on the corresponding outlier scores and the corresponding change point scores; and

displaying a predetermined number of the plurality of data pieces that are at a top of the sorted order of the plurality of data pieces as outlier and change point candidates of the data series.

12. (Previously Presented) The outlier and change point detection method of claim 8, further comprising:

selecting particular data pieces of the plurality of data pieces that have corresponding outlier scores and corresponding change point scores over predetermined thresholds as the candidate outliers or change points for the data series.

13. (Previously Presented) A device for inputting a plurality of data pieces of a data series and for calculating outlier scores and change point scores for the plurality of data pieces to be used for performing data mining with respect to the data series, said device comprising:

a first time-series model learning device for sequentially inputting each data piece of the plurality of data pieces, and for learning, for each data piece of the plurality of data pieces when the data piece is input, a corresponding parameter of a probability density function related to the data piece based on one or more data pieces of the plurality of data pieces that have already been input to the first time-series model learning device;

an outlier score calculator for inputting, for each data piece of the plurality of data pieces, the data piece and the corresponding parameter learned by the first time-series model learning device, and for calculating, for each data piece of the plurality of data pieces, a corresponding outlier score based on the corresponding parameter and one or more data pieces of the plurality of data pieces that have already been input to the outlier score calculator;

a moving average calculator for sequentially inputting the corresponding outlier score calculated by the outlier score calculator for each data piece of the plurality of data pieces, and for calculating, for each data piece of the plurality of data pieces, a corresponding moving average based on one or more of the outlier scores from the outlier score calculator that have already been input to the moving average calculator;

a second time-series model learning device for sequentially inputting the corresponding moving average calculated by the moving average calculator for each data piece of the plurality of data pieces, and for learning, for each data piece of the plurality of data pieces when the corresponding moving average is input, a corresponding particular parameter of a particular probability density function related to the corresponding moving average based on one or more moving averages from the moving average calculator that have already been input to the second time-series model learning device; and

a change point score calculator for inputting, for each data piece of the plurality of data pieces, the corresponding moving average calculated by the moving average calculator and the corresponding particular parameter learned by the second time-series model learning device, and for calculating, for each data piece of the plurality of data pieces, a corresponding change point score based on the corresponding particular parameter and one or more moving averages from the moving average calculator that have already been input to the change point score calculator.